VIA UPS

Mr. David Keith
Project Coordinator
Anchor QEA, LLC
614 Magnolia Avenue
Ocean Springs, MS 39654

RE: Draft Chemical Fate and Transport Modeling Study Report
San Jacinto River Waste Pits Superfund Site, Harris County, Texas
Unilateral Administrative Order, CERCLA Docket No. 06-03-10

Dear Mr. Keith:

The Environmental Protection Agency (EPA) and other agencies have performed reviews of the above referenced document dated February 2012. The enclosed comments shall be incorporated in the Final Chemical Fate and Transport Modeling Study Report and copies provided for review and approval in accordance with the approved schedule.

If you have any questions, please contact me at (214) 665-8318, or send an e-mail message to miller.garyg@epa.gov.

Sincerely yours,

Gary Miller
Remediation Project Manager

Enclosure

cc: Luda Voskov (TCEQ)
Bob Allen (Harris County)
Nicole Hausler (Port of Houston)
Jessica White (NOAA)

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Comments
Draft Chemical Fate and Transport Modeling Study Report dated February 2012

1. **(Section 1.1, Section 4.2.2, and Appendix G):** An effective bed roughness value of 1.0 cm was used for the current velocity calibration. However, in the sediment transport modeling, bed shear stress was calculated using an effective bed roughness value of 2 mm. The apparent use of a model effective bed roughness value that is different from the calibration effective bed roughness value violates the purpose of determining calibration values and introduces significant error into the simulation results for sediment transport processes (e.g., erosion, re-suspension, deposition, etc.). The modeling shall use parameters that are consistent with the calibration results unless there is a justification of the validity provided for the departure.

2. **(Section 2.1, p. 7):** Vessel effects and wind-generated waves were not included in model. These effects shall be included and described in the report.

3. **(Section 3 and Appendix A):** The bathymetry and floodplain topography of the model domain were used to define the thickness (water depth) of each model cell. Various datasets were used to assign cell values. Where data were not available for individual cells, values were assigned by interpolation of existing cell data. Details of the interpolation method(s) are not provided in the report. The report shall include this information.

4. **(Section 3.3.1, p. 15):** Inflow rates at the Lake Houston Dam include tainter gate discharge. However, the tainter gate position is adjustable and the methodology used to account for its rating curve with respect to its height variability is not provided. The report shall provide this information.

5. **(Section 3.3.3, p. 20):** This section selects 16 ppt as the salinity inputs from the bay boundary of this model. This selection seems somewhat arbitrary. Recent work (for example: Technical Support for the Analysis of Historical Flow Data from Selected Flow Gauges in the Trinity, San Jacinto, and Adjacent Coastal Basins at http://www.twdb.state.tx.us/RWPG/rpgm_rpts/0900010996_GalvestonBaySalinity.pdf) presents the fact that salinity does vary in this system contrary to the statement in this section that states “Salinity has minimal variation in the system...” The report shall clarify whether water density variation within the range of salinity variation at this site affects potential transport of sediments and ultimately the pollutants at this site.

6. **(Section 3.3.3, p. 20):** The hydraulic regime at the confluence of the Houston Ship Channel at the San Jacinto River (Battleship Texas gauge station) is fundamentally different than that which occurs at the mouth of the San Jacinto River at Galveston Bay (Morgan’s Point gauge station). While approximately symmetrical tidal currents can be expected at both the Battleship Texas and Morgan’s Point gauge stations during non-event periods, the symmetry should not exist during periods of flooding. A decoupling of water surface elevations between stations is expected during flood events due to a local heightening of water surface elevation from increased freshwater flow at the mouth of the Houston Ship Channel compared to that of the more tidal-influenced, more open marine

environ of Galveston Bay (e.g., Thomann, 1987). Consequently, the water surface elevation response at the downgradient model domain boundary (Battleship Texas) would be significantly different than the water surface elevation response downstream at Galveston Bay (Morgan's Point) during a flood or surge event. As such, the use of data from Morgan's Point may to be inappropriate for use in calibrating the subject model. For the purpose of satisfying the necessary verification of the hydrodynamic model calibration, the following procedure shall be used: 1) use the current model calibrated with non-flood event water surface elevation data, 2) find a period of time for which data exist at the Battleship Texas station and over which a significant flood event is observed, 3) run the EFDC model, as calibrated, 4) from the resulting model run: compare the simulated water surface elevations at Battleship Texas (which is contained within the model domain against the actual data collected at the same gauge station, and finally 5) from the resulting model run: compare the model-predicted water surface elevations at Battleship Texas against the observed water surface elevations at the Morgan's Point gauge station. The report shall include a description of this procedure and the results to determine whether event-driven decoupling of water surface elevations is observable and on what scale it may occur.

7. **(Section 3.4, p. 20; and Appendix B):** Acoustic Doppler Current Profiler (ADCP) data during May 10 – July 13, 2011 were used in calibration, but data during July 14 through November 15 (Appendix B) were not compared to the model results. The report shall include a comparison of the model results to the July through November data.

8. **(Section 3.4, p. 21):** Depth average velocity at high flows is accurately simulated, but model underestimates east-west velocity component by 50%. This underestimation of east-west velocity may result in less modeled sediment and therefore dioxins moving laterally from the waste pit sites into the stream thalweg for downstream and upstream transport. The report shall include a model sensitivity study to assess this and provide a discussion of the results.

9. **(Section 4.2.2, and Appendix C):** Class 1 cohesive bed sediment was classified as having a median particle size (D50) of 0.25 mm. Therefore, cohesive bed sediment is characterized by a grain-size population where 50% of the particle mass is medium sand or larger (e.g., Folk, 1972) and can be classified as "fine to medium sand." In a description of SEDZLJ, the program module is used to simulate sediment bed erosion and deposition (Sec 4.1). Sediment grain sizes larger than 0.2 mm are considered to be non-cohesive (James et al., 2005). Based on the discussion here, most of the sediment comprising the cohesive Class 1 category is composed of grains defined as non-cohesive. The simulation of sediment ascribed as cohesive whose dominant make-up is actually non-cohesive leads to results that adversely affect the goal of realistic sediment bed simulation. One specific result is the tendency for Class 1 sediment gross erosion to be under-estimated. Class 1 sediment is defined in Sec 5.2.8.2.1 of the report as being composed of particle size less than 62 μm. The D50 for median particle size shall be consistent with this Class 1 particle size definition.

10. **(Section 4.3, p. 32):** The report indicates that the sediment transport model was, in part, calibrated using the settling speed of Class 1 sediment. The Class 1 settling speed used in

the calibration is reported to be 1.3 m/d. However, the equation used for Class 1 (cohesive) settling is not evident in the information provided in the main text and Appendix G of subject report, or from James et al. (2005). The report does not include information regarding the specific model used in the determination of the Class 1 settling speed and/or the equivalent effective median grain size of the Class 1 fraction. The report shall include this information.

11. **(Section 4.5, p. 36):** A consequence of designating the boundary condition for in-coming sediment load to be a proportion of sediment load entering Lake Houston is that the in-coming sediment load must equal 0.0 mg/L during periods when there is no discharge at the Lake Houston Dam. This shall be confirmed, and a discussion of the potential consequence to model calibration shall be included.

12. **(Table 4.1):** The cohesive Class 1 sediment erosion flux to suspended load (vs bed load) is not based on class size D_{50}, rather, it is calibrated. The report does not provide information regarding the value(s) of effective diameter for Class 1 sediment resulting from the model calibration. The report shall include this information.

13. **(Figures):** A map shall be included, which displays gross erosion rates in the model domain, including all cells for which Egross=0.0, based on Equation G-26.

14. **(Appendix E):** A single value for the three erosion rate parameters was obtained for each of the five depth intervals from each core. A "log-average" (geometric mean) value was determined for the proportionality constant, *A* (Equation E-1), at each depth interval (Table E-6). As is normal, the geometric mean results in values of *A* for the Sedflume data sets (Table E-1 through Table E-5) are significantly lower than the arithmetic mean for the same data sets. Use of the lower values of A results in significantly lower values of the average gross erosion rates for each depth interval (Equation E-2). No rationale is provided to justify use of the geometric mean for the proportionality constant, and the report shall provide this rational.

15. **(Appendix E):** The results of the Sedflume experiments were used to develop average critical shear stress (τcr) values for each sediment layer (e.g., Table E-1 through Table E-5). However, the *average* critical shear stress (τcr) values (Table E-6) were determined using the arithmetic mean, not the geometric mean (as for the proportionality constant), which results in the significantly higher value of the two means. The use of the higher arithmetic average value, rather than the lower geometric average value for the critical shear stress (τcr) results in a lower gross erosion rate (Egross; e.g., Equation E-2). Together with the geometric average of the proportionality constant, the use of the arithmetic average of critical shear stress reinforces a biased tendency towards lower erosion in the model domain. The report shall provide a rational for the use of the arithmetic mean.

16. **(Appendix F):** Of the ten (10) cores used in the $_{137}$Cs isotopic study, data from only one core (SJR1005) were usable (e.g., Table F-3). Evaluation of the data from Core SJR1005 indicates there were only two detections (Figure F-6). The two data points from Core SJR1005 were used to assign a date to the corresponding sediment depth from which a net sedimentation range was determined (e.g., Table F-3). However, the

report does not provide which of the four (4) typical interpolation methods (e.g., USGS, 2004) were used. The report shall include this information.

17. **(Appendix F and Appendix H):** The $_{137}$Cs and $_{210}$Pb activity analytical results were reported with significant experimental error (e.g., Figure F-2 through Figure F-11, Subject Report). Linear regression was performed to find the slope of the line defined by those 210Pb data that were judged to be unsupported (Append F, Subject Report) versus their core depth to determine net sedimentation rates (Figure F-12 through Figure F-26, Subject Report). However, the regressions do not incorporate the variance of experimental error associated with each datum. Therefore, a range of slopes and, consequently, net sedimentation rates, exists at each core location. Only "mean" net sedimentation rates are reported, but not the significant deviation inherent in the analyses. Use of $_{137}$Cs isotopic data from a sediment core for determining net sedimentation rates and/or age dating is predicated upon corroborating data obtained from other cores in the same depositional system (e.g., USGS, 2004). However, in this instance, there are no such corroborating data. Therefore, the single $_{137}$Cs net sedimentation rate (Item H.2) reliability or applicability to the model domain cannot be determined. An evaluation of the net sedimentation rates in the model domain was also performed using the $_{210}$Pb isotopic system. Contrary to the more suitable applicability of the $_{137}$Cs isotopic system to a depositional environment that is relatively dynamic (Item H.1), the $_{210}$Pb system "… *performs best in relatively quiet depositional areas* …" (Jeter, 2000). The $_{210}$Pb system age dating method is "… *more useful for age-dating cores from low-sedimentation-rate lakes with undisturbed watersheds where the input of contaminants is dominated by atmospheric fallout* …" and is less useful "… *in high-sedimentation-rate lakes with developed watersheds where the input of contaminants is dominated by fluvial loading from one or more streams* …" (USGS, 2004). As such, the $_{210}$Pb method would be expected to be even more adversely affected by the depositional environment than that for the $_{137}$Cs system and is significantly less suitable to the relatively high-energy depositional environment that comprises the subject study area. Model sensitivity runs shall be completed for a full range of net sedimentation rates, and the results discussed in the report, as well as the rational for selecting the ranges of net sedimentation rates.

***Includes NOAA comments & TCEQ comments through #* 18**